THE PLANNING OF TECHNOLOGIES FOR FUTURE RURAL POPULATIONS

An Introductory Paper

By

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Rural development is so varied and so complex, involves so many disciplines, and is so lacking in explanatory or prescriptive theory, that it is often hard to see the wood from the trees. At one pole the pedantic data-mongering of some academic research leads off into stamp-collecting trivia; and at the other pole some practical philistines indulge what has been called 'the intellectual rigour of almost total ignorance' (Weir 1975:174). Pedants and philistines alike see quite clearly what is very close to them, or think they do, but they see different aspects of the same things and cannot describe them to one another, and would not listen if they could. Naturally then, a priority seems to be to open up communication between these two wings and between those who are nearer to the middle ground. But the thrust of this paper is rather different; it is, as it were, upwards and outwards rather than across. Whether it achieves the sublime irrelevance of outer space the reader will judge. But the underlying assumption is that a more imaginative and future-oriented approach is needed to rural development in much of the third world, and that this cannot be achieved if one is anchored either in the snug security of academic particularisms or in the crude pragmatism of the man who thinks only of day-to-day affairs. To those who find the approach fanciful or futile, the challenge is down to propose something better.

The argument of this paper originates in near-despair at future prospects in many of the rural areas in the third world, but particularly in South Asia. A recent set of projections for South Asia gives rural populations of 980 million in 1975 rising to 1559 million by the year 2000, an increase of 59 per cent (UN 1974:64). This, ~~it should be noted,~~ is in

spite of a near-trebling of urban populations in the same region in the same period, from 288 millions to 825 millions. The observation that "Simultaneous pressures on the population in both "urban" and "rural" localities may conceivably give rise to new forms of settlement of a character which can no longer be described by traditional concepts" (Ibid:65) ~~may be~~ seems a polite way of saying that the mind boggles at the prospect, and it is difficult, thinking conventionally, to imagine how acceptable livelihoods can possibly be provided for such numbers of people.

The gloom deepens when one considers past failures and future difficulties. Land reform in South Asia has been an almost universal farce. Brave-looking initiatives to reach the poor have been perverted to benefit the better-off. Improving the management and operation of government agencies ~~hardly looks a promising line of attack in the absence of~~ may have some potential but will always be weak unless accompanied by powerful and persistent political will to secure a more equitable distribution of resources. Inflation in food prices has inflicted great but unseen suffering on millions of dispersed and invisible rural people. The green revolution has begun to wilt. Family planning, we are told, will not catch on before there is social and economic progress, and social and economic progress becomes less and less possible as family planning fails to catch on. Revolution, whatever that means, poses as a simple solution but might generate more suffering than it relieved. Meanwhile the population continues to grow and prospects become more, not less, daunting.

Pessimism has been in fashion, but views of the world food and population situation have their own hog cycle, and we may currently be starting to rise out of one of the troughs. In sympathy with that rise, I shall argue that there is one major line of attack on the problems of future rural living which ~~should~~ remains to be explored as a field for sustained and systematic action. This is the planned specification and development of technologies appropriate for specific future rural environments, working backwards from future populations and resource endowments to identify present R & D priorities.

The argument is that technologies, once devised and available, are a relatively immutable component in the rural environment. Political systems, organisational structures, management procedures, laws, administrative fiats, taxation systems and the like can all and are all subverted by local elites to serve their own privileged interests. In contrast, a technology, once created, is a relatively unalterable reality, a piece of

the furniture.

But technologies, as is very well known, have marked income and resource distribution effects. Big expensive irrigation pumps help big men to appropriate communal groundwater; smaller pumps spread some of the benefits to the smaller men. Modern rice mills employ fewer, more skilled operatives at high wages; traditional rice hullers employ more less-skilled and poorer people at lower wages (Harriss 1974). Examples do not need to be multiplied for we are considering a commonplace. What does not seem to be commonplace is following through the implications of this fact into relevant R & D decisions. Income and asset distribution effects can be planned into the R & D which creates new rural technologies; further, the very choice of the technologies to develop can be determined by a view of the sort of society which is desired. This may not be a path to a Brave New World, in either the positive or ironic sense, but it may provide a much surer way of moving towards more acceptable rural societies than either political engineering or administrative reform.

This assertion may go further than the point reached by many who support the intermediate technology movement. That movement has been properly engaged in spreading the gospel of developing, improving and transferring appropriate technologies. The approach, as far as it has gone, has been sensible, but it has tended to be piecemeal - bamboo tubewells here, bicycle trailers there - a series of generally intelligent and useful but inadequate initiatives. Moreover, it is in danger of failing to influence the crucial energy-substitutes R & D, the results of which may burst upon the rural third world in the next two decades. There may at this moment exist a tragic gap between those who perceive the needs of rural societies and those who are creating the technologies which they will come to use and which will determine much of their form.

The approach advocated to fill the gap is to plan the R & D. The initial stages and the planning process are these. First, the characteristics of a desirable rural future are specified. This involves values and will always be open to argument, but is an essential step. Second, the anticipated relative endowments of the four prime resources - land, water, energy and people - are assessed for a particular rural environment. The third step is to specify the characteristics of a technology which would link those resource endowments in such a way as to achieve the desired characteristics. Often, perhaps usually, the technology will be found

not to exist. The challenge, then, is to create it.

This approach can be illustrated with a set of specifications for rural futures, and with the resource endowments of four rural environments, two in Asia and two in Africa. These concrete examples, better than any abstract argument, will expose some of the strengths and weaknesses of the approach. The presentation is brief and summary, reflecting the early stage of thinking reached.

Five desirable characteristics for future rural environments can be proposed:

(i) Stability The ecological system should be stable. This includes declining or nil uses of non-renewable resources.

(ii) Productivity The productivity of whatever resources are scarce should be higher rather than lower. Conversely, abundant renewable resources can be used relatively wastefully.

(iii) Livelihood-intensity More rather than fewer livelihoods should be generated by the system.

(iv) Continuity Incomes and food supplies should be generated over more rather than less of the year.

(v) Equity Resources and benefits derived from resources should be distributed more rather than less equally among the population.

Taken together, these five characteristics or criteria are designed to embody a holistic and ecological view of human existence. To describe any device which links them together as an eco-technology may be straining to make a new word. There is, however, a meaning here which justifies a specific expression such as eco-technology, which can be associated both with a stable and balanced relationship between man and his organic and physical environments, and with an equitable and continuous flow of benefits to individuals.

These five criteria are, however, a value-loaded personal choice. Each person and each ideology will have an idiosyncratic choice of criteria

and of the relative weights to be attached to them when there have to be tradeoffs. (The very act of writing out such a list is an illuminating exercise). The important point here, however, is not the exact details of this list, but the fact that such a list can be drawn up. Another list applied to the environments to be described might produce different specifications. This does not invalidate the approach; to the contrary, it demonstrates its versatility.

The four environments to be considered are:

- the well irrigation areas of North Arcot District in Tamil Nadu
- the Himalayan foothills
- parts of the Eastern Sudan
- parts of Western Tanzania

(i) <u>The well irrigation areas of North Arcot District</u>

In the well irrigation areas of North Arcot District, water is scarcer than land. The water table is subject to a secular decline (Bandara 1974), apparently as a result of over-extraction by electric and oil pumpsets. There is a vast energy endowment in sunlight, but much less in hydroelectric potential, and forestry does not present a major opportunity for storing energy. Between 1970 and 2000 the rural population is expected to increase by at least three-fifths. There is already serious under-employment with a substantial migrant proletariat.

The technology required must ration water and must not use non-renewable energy resources; it must be much more livelihood-intensive in order to sustain more equitably a much larger population; it should encourage much more productive uses of water; and it must enable productive work to be carried out during much of the year. Such a technology might be found in the use of solar energy for lifting water. If this technology were developed so that it was very small-scale, had negligible recurrent costs, and had a suitably specified lifting power, it might, once adopted, meet the criteria as follows:

Stability: rationing the groundwater by extracting less and using only renewable energy sources in the form of

solar radiation.

Productivity: increased productivity of water might follow through more water-sparing (and labour-intensive) application, adopted because of its scarcity.

Livelihood-intensity: The livelihood-intensity of water use might be greater in that there would have to be many more wells and each well and pump could require one person or family to operate it.

Continuity: allowing cultivation during most or all of the year with the lesser amounts of water made available from wells.

Equity: through the sinking of many more wells, necessary because of the small-scale of the technology, setting the scene for a redistributive reform through an eventual policy of "well, pump and land fo the irrigator".

Feasible paths towards the adoption of such a technology have been discussed elsewhere (Chambers 1974), but the technology does not yet exist. In the meantime, R & D work is in hand in several parts of the world (including the UK, France, the Sahel, and India) to develop solar pumps. Unless there is a conscious and powerful planning intervention, it would be a matter of sheer coincidence if any of the solar pumps which are developed had an appropriate scale, lift-power, and other characteristics for a desired future in any part of rural India. The most likely outcome may be, once again, inappropriate technology, which will displace livelihoods, enhance inequity, and strike yet more misery into rural lives.

(ii) <u>The Himalayan Foothills</u>

The Himalayan foothills have a very different endowment of the four resources:

- land: land for stable cultivation is very limited. Considerable areas of land are suitable only for forestry or the growth of tree crops;
- water: the rainfall is high and abundant water is available in rivers in valley bottoms;
- energy: there is a vast hydro-electric energy potential;
- population: at existing levels of technology and economy, the population is reducing the potential of the land through erosion from cultivating steep slopes; and the population can be expected to increase.

For this environment, the technology that can be suggested is

a livelihood- and energy-intensive method for processing trees, tree crops, and vegetation. If the main organic raw materials are lignin and cellulose, then the question arises to what uses they can be put, and in what ways they might be processed to result in a usable product. An energy-intensive process for converting lignin or cellulose into carbohydrates or other foodstuffs, whether for human or animal feed, appears an obvious possibility. The danger is that unless there is deliberate intervention at the R & D stage, which is probably already in hand, the technology developed will be capital-intensive and labour-sparing. The capital-intensity may not be so very serious a problem, but a labour-sparing technology would be inappropriate. The implication is that, as with the North Arcot case, the R & D itself has to be deliberately designed to meet the specifications of the future environment.

(iii) The Eastern Sudan

The Eastern Sudan presents a sharp contrast with the two previous cases. Land is abundant. Water is limiting. The rainfall is concentrated in a few months, and in the areas with which we are concerned irrigation is not feasible. There is a vast energy endowment from sunlight. The population is low in relation to the land. The current system is inefficient in terms of continuity and stability. Agricultural activities are crammed into a short period. Ploughing is carried out by tractors working 24 hours a day in order to catch the rains. Weeding and (even more so) harvesting present critical labour demands which are met by importing casual labour from far afield. Continuity of employment is very low as a result of this peak; and stability is poor in that large amounts of fossil fuels are consumed by the tractors.

For this environment the technology required is one which will combine continuous employment with storing solar energy and using that stored energy for cultivation and perhaps also for weeding and harvesting. It is possible to envisage a situation in the Eastern Sudan in which some people make their living through small scale energy storage from solar radiation, and either sell that stored energy to others or use it for their turn of a communal solar-energy-powered tractor. Much R & D work

may be in hand for the storage of solar energy. It is to be wondered, though, whether the livelihood-intensity of the finished technology will ever have crossed the minds of the researchers as a design criterion.

(iv) Western Tanzania

Western Tanzania is yet another contrasting environment. Land is abundant and population scant. There are vast extents of wooded bushland which is uncultivated and unexploited by man. Water is largely limited to a moderate rainfall. The solar energy received is huge and some of it is stored naturally in the bush. The hoe is used in a shifting cultivation.

The scarcest resource is labour and the most abundant land. Appropriate technologies here might centre on the use of the bush for energy, treating much of the area as an energy farm. Charcoal burning is a cinderella among rural activities, but much practised already as a form of energy farming. The technologies required include more labour-extensive techniques for charcoal burning, and vehicles, including tractors, which operate on charcoal. It is arguable that Tanzania as a whole should convert its public transport to charcoal, but, for this specific area, charcoal might provide the appropriate energy source for more labour-sparing agriculture.

The specifications of these four technologies - small-scale solar pumps for North Arcot, energy- and labour-intensive uses for wood and vegetation in the Himalayan foothills, livelihood-intensive storage of solar energy in the Eastern Sudan, and labour-sparing charcoal burning and charcoal locomotion for Western Tanzania - are vulnerable to objections. There may be technical and economic reasons why such technologies will or would prove non-viable. With the possible exception of charcoal locomotion, they do not exist in a developed form. There may be inherent characteristics in the physical processes which rule out some or all of the desirable characteristics. But none of these objections invalidates the approach. It takes very little time and not much imagination to reach this stage of specification. That the approach can yield specifications in all four of the environments suggests that it may be very widely applicable.

To take the approach much further requires a special input of manpower and planning. Vigorous exploration of its potential might involve:

(a) mobilising professionals competent both in technical aspects and in rural development;
(b) a rapid development of long-range environment-specific planning for rural areas carried out by imaginative specialists in the countries concerned;
(c) the creation of R & D capability to develop technologies on which work is not currently in hand;
(d) a major application of funds from whatever sources to modify R & D to ensure that the technologies which emerge are appropriate for the rural environments of the third world.

The urgency of such initiatives lies in the preemption of choice which can take place in the early stages of R & D. In the words of a recent report "A social policy should be built into the new technology beginning with the basic research itself" (UNRISD 1974:52-3). Most of the R & D concerned is probably taking place in the richer countries. The great danger is that once again the technologies which come out, far from being designed to improve life in rural environments, will make it worse; that they will be capital-intensive, large-scale, and livelihood-displacing. It is difficult to see how this can be avoided, at least in the energy-substitutes field, without a major and rather high-powered effort. A first step might be to create a mobile and well-informed task force with established world-wide contacts and communication.

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